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(54) **COMPOSITION AND PROCESS FOR IMPROVING THE COMBUSTIBLES COMBUSTION AND PROCESS FOR OBTAINING SUCH COMPOSITION**

ZUSAMMENSETZUNG UND VERFAHREN ZUR VERBESSERUNG DER VERBRENNUNG VON  
BRENSSTOFFEN UND VERFAHREN ZUR HERSTELLUNG

COMPOSITION ET PROCEDE D'AMELIORATION DE LA COMBUSTION DE COMBUSTIBLES ET  
PROCEDE D' OBTENTION DE CETTE COMPOSITION

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## Description

**[0001]** The invention relates to a composition and a process for improving the combustion of any kind of combustible, liquid, solid or gaseous, inferior or superior, in industrial or home firing installations. Also the invention relates to a process and device for obtaining such composition. Although the invention may be used for treating the combustion of any combustible type, the most remarkable results may be obtained in treating the combustion of inferior combustibles implying complicated and expensive firing technologies, and generating important corrosion and the pollution of the environment.

**[0002]** There are many compositions and processes used for enhancing the combustibles combustion and/or preventing the appearance of the deposits and corrosion phenomena destined to be principally used in industrial firing installations and less in the home ones, because of their complexity and the relative high price they involve.

**[0003]** One of the most used and applied processes for increasing the total energy produced by the liquid, gaseous and mostly fossil combustibles combustion, using the burners, consists in the modification of the physical - chemical conditions of the combustion reaction. On this purpose, an activator liquid, more precisely a combination of chemical compounds with surface inhibitor peroxidant, is introduced as aerosol in the combustion air. This way, in order to obtain a control over the homolitic fractures of the chemical bonds of the combustible molecules, a steady contribution of free radicals - especially new oxygen free radicals - is acquired on purpose to eliminate the ceasing reaction phase and assure a larger number of molecules participating in this reaction. Similarly, a composition capable of modifying the physical parameters of the combustible is also introduced in the combustion air, which allows all the molecules participating in this reaction to be effective. Simultaneously, the surface properties of a chemical combination introduced in the combustion air are also controlled through some surface agents. Lastly, for the reduction of the boiler corrosion, some corrosion inhibitors are introduced in a composition also introduced in the combustion air.

The installation for achieving the process includes an active carbon filter for air, some vessels in which the said compositions are introduced, some air dosage pumps with piston, membrane or of other type, as well as some slide-valves or intermediate regulating-keys for the flow adjustment. The air generated by the dosage pumps is bubbling into the compositions generating the aerosols, and the additivated air flow so formed is regulated by using the intermediate slide-valves and mixed with the rest of the combustion air sent to the burners. In case the additivation air installation is damaged, a safety device is stopping the combustible access to the burners.

**[0004]** In time, both the process and the installation

have suffered some changes and improvements, but their functioning general principles are still the same.

Hence, the known compositions include at least one compound capable of releasing active oxygen, the choice being preferably made between the hydrogen (oxygen) peroxide, alkali or alkali-earth metals peroxides.

According to the known process, the peroxide used is previously introduced in a reduced fraction of combustion air, reunited with a principal fraction of combustion air, and the both fractions are introduced in the combustion chamber, preferably at a burner nozzle level. On the purpose to introduce the peroxide in the combustion air, the reduced air fraction is passed through a liquid containing the said peroxide. The other compositions are suffering the same process. The improvements are related, in principal, to achieving the best compositions, and the precise parameters in which the process have to be developed, as well as improving the installation for obtaining a more stable and optimum flow. Another problem to be solved is achieving a simple, one alkaline metal-based composition, a process and an installation which allow both the improvement of the used combustible combustion and the prevention of the appearance of deposits and corrosion phenomena and, in case the said deposits already exists, their elimination. Another purpose of the said invention was its applicability both to industrial and home firing installations.

**[0005]** The Romanian patent TO 113489, of the same author, successfully resolves this technical problem by starting from the use of the sulfuric acid permanently produced during the combustible combustion for the oxidation of the combustible stable particles (the unburned substances), by using a alkaline metal combinations-based (salts) composition for additivating the combustion air in industrial and home firing installations. The said composition consists, in a first preferred embodiment, in ~ 95% of 6% solution of potassium dichromate in de-mineralized water, 2 - 3% ammonia and 2 - 3% of non-additivated mineral oil. In another preferred embodiment the said composition consists in ~ 95% of 1% solution of potassium permanganate in de-mineralized water, 0,5-1% of ammonia and ~ 4% of non-additivated mineral oil, all the proportions being reported to the weight, the first embodiment being especially designed for liquid combustibles and the second preferred embodiment, much more active, for solid combustibles. The additivation process consists in diluting any of these compositions in distilled water, in quantity of 1/1 to 1/6 shares of weight, transforming it in aerosols by using a fraction of combustion air blast introduced into the focus together with the rest of the combustion air, in proportion of 0.01 - 0.05% active solution from the total quantity of the air necessary for burning the liquid and gaseous combustible or 0.1 - 0.15% for solid combustible, all proportions being reported to the weight. The dilution in distilled water of any composition is depending on the temperature of the combustion air fraction blast namely the

dilution is proportionally decreasing with the decreasing of the temperature.

**[0006]** The additivation installation for treating the air necessary to the combustibles combustion, using the composition with the above mentioned characteristics, was quite simple; it includes a single recipient provided with pneumatic stirrer, which contains the chosen additivation composition depending on the used combustible and a set of air ducts for transporting the additivated air to the focus (burner). It also includes a compressor, which produces the necessary air for generating the aerosols and a regulating loop with the role of maintaining a constant proportion of active solution in the combustion air, depending on the total air quantity necessary for burning process. These technical solutions present some disadvantages:

- the necessity to inject the additives into the combustibles in the case of certain combustibles and firing systems;
- the necessity to increase the chemical stability of the said compositions, especially when great temperature variations occur, into the environment.

The technical problem resolved by the present invention consists in obtaining a similar alkaline metal combinations-based composition (solts) of great stability, but which can be introduced either in the used combustible or in the combustion air, depending on the situation. Also, the technical problem resolved by the present invention refers to a process for treating combustibles of different types with this composition, to the process of obtaining the composition as well as to a device for obtaining the composition using this process.

**[0007]** The potassium combinations-based composition for the combustible additivation according to the present invention may be realized in two different variants depending on the used combustible type. In the case of firing installations using common liquid or gaseous combustibles as well as the firing installations using solid combustibles simultaneously with liquid or gaseous combustibles for enhancing the burning process, the composition contains ~ 20% of 6% watery solution of potassium dichromate, treated with monochromatic light having  $\lambda - 480-490 \cdot 10^{-9}$  meter; 0,02% ammonia; 0,2% non-additivated mineral oil; ~80% de-mineralized water. In case of firing installations consuming solid combustibles e.g. coal, solid deposits, or liquid combustibles with a high viscosity, higher than the fuel oil's, as bituminous shale, refinery deposit, the composition to be used is a more active one, including the following constituents: ~ 10% of 5% watery solution of potassium permanganate, treated with monochromatic light having  $\lambda \sim 595-625 \cdot 10^{-8}$  meter; 0,05% urea; 0,3% non-additivated mineral oil; ~90% de-mineralized water. Any of this two compositions may be used or introduced in the combusting air or in the combustible, the proportions remaining the same. In case one of the compositions is

introduced in the combustion air, its volume ratio comparing with the combustion air will be of  $\sim 5 \times 10^{-7} \pm 20\%$ . In case the additivation composition is introduced in the combustible, the corresponding quantity of active substance is calculated reported to the nominal combustion air quantity for combustion (firing) process. Taking into account the composition quantity, expressed in grams of active substance, which has to be introduced in the combustion air or directly in the combustible reported to the heat quantity produced in the plant there are 0.025 gr.  $\pm 20\%$  for each  $10^9$  cal.

**[0008]** The process for obtaining any of these two compositions includes the treatment of the active substance, consisting, in the first variant, in potassium dichromate in aqueous solution 6% and, in the second variant, in potassium permanganate in aqueous solution 5%, with a monochromatic light having the wave length above mentioned. This way, the active substance flows, continuously and uniformly, along a horizontal circulation trough in a thin layer of maximum 3mm and is allowed to easily drop along the generating line of a horizontal quartz glass cylinder, which rotate with a constant number of revolutions in the liquid flowing direction on the circulation trough. The monochromatic light generator continuously gives out light, along the cylinder axis, during the whole liquid flow period. The colour filter of the monochromatic light is chosen depending on the wave length necessary for the active substance to be treated.

**[0009]** The device for treating with monochromatic light is made of a circulation trough, placed with the tap hole above and parallel to a quartz glass cylinder, which is being driven in a rotating movement around its own axis, so the treated liquid is flowing along the glass cylinder superior generating line. A monochromatic light generator is placed at one cylinder end and a mirror is placed perpendicularly to the cylinder axis, at the other one. The liquid flowing along the rotating cylinder is collected in a collector vessel.

**[0010]** The advantages provided by the present invention are believed to be self-evident in view of the long-accepted disadvantages of previously proposed compositions and processes for improving the combustible combustion, and are the following:

- the introduction of compositions is maintained constant, whatever the combustible quality variation or the firing installation thermal load variation may be;
- if applied in the correct manner, each composition allows full achievement of the goals of the additivating process, namely the removal of the deposit on the heat exchange metallic surfaces, inhibition of the corrosion, decreasing of the corrosive and harmful emission, decreasing of the negative impact over the environment;
- the metals whose salts given out to environment are harmful, e.g. Cr, Ni, Mn, are kept inside of the firing installation on the metallic sides of the focus, as pro-

protective layers against corrosion.

**[0011]** Two preferred embodiments of the invention depending on the used combustible characteristics will now be described by way of examples with reference to the accompanying drawings in which:

- Fig. 1 shows device for the monochromatic light treatment of the composition active substance
- Fig. 2 shows block diagram for the liquid combustible treatment with the additivation composition;
- Fig. 3 shows block diagram for the gaseous combustible treatment with the additivation composition.

In the case of firing installations using common liquid or gaseous combustibles as well as the firing installations using solid combustibles simultaneously with liquid or gaseous combustibles for enhancing the burning process, the composition contains:

- ~ 20% of 6% watery solution of potassium dichromate, treated with monochromatic light having  $\lambda$  -  $480-490 \cdot 10^{-9}$  meter;
- 0,02% ammonia;
- 0,2% non-additivated mineral oil;
- ~80% de-mineralized water.

The composition used for firing installations using solid combustible, e.g. coals, solid deposits, or liquid combustibles with high viscosity (higher than the fuel oil's) like bituminous shale, refinery deposit, consists in:

- potassium permanganate in aqueous solution 5%, treated with monochromatic light with a wave length  $\lambda \sim 595-625 \cdot 10^{-9}$  meter, in total proportion of ~10%;
- urea 0,05%;
- non-additivated mineral oil 0,3%;
- de-mineralized water ~ 90%.

All these proportions are reported to weight.

Any of the two compositions may be used or introduced in the combustion air or in the combustible, maintaining the same proportions. In case one of the compositions is introduced in the combustion air, its volume ratio related to the combustion air will be of  $\sim 5 \times 10^{-7} \pm 20\%$ . In case the additivation composition is introduced in the combustible, the active substance quantity will be calculated taking into account the nominal quantity of combustion air needed for the combustion process.

**[0012]** Considering the composition of the active substance - expressed in grams - which has to be introduced in the combustion air or directly in the combustible compared with the heat quantity produced in the installation there are  $0,025 \text{ gr} \pm 20\%$  for each  $10^9$  cal. produced.

Having in view that ammonia can be replaced by urea,

the combustion air can be additivated with ammonia and the combustible with urea.

The process of treating with monochromatic light will now be disclosed.

5 introducing any of these compositions either in the combustion air as activator vapors, or in the combustible for the combustion process, it will react with the corrosion products formed during the combustible combustion process and it will neutralize them. Analyzing the produced effects it looks like a new chemical compound is appearing in these reactions, one can assimilate it (as chemical formula) with  $\text{H}_2\text{SO}_5$  which reacts only with the molecules of unburned substances molecules of the combustion products. The said reaction begins at temperatures of  $\sim 750^\circ\text{C}$  and ends after the temperature decreases below  $\sim 100^\circ\text{C}$ . This compound should have a short period of existence having a free oxygen ion attracted. The oxygen ion will start the oxidation of surrounding particles, and as at the moment of the  $\text{H}_2\text{SO}_5$  appearance the substances easy to be burned have already been oxidated, it will go towards any unburned substances, including towards those from the deposit on the heat exchange surfaces. So, essentially, it will be a mutual neutralization of two major disadvantages of the combustible combustion, especially of the inferior ones, possible as a result of the contribution controlled by the additive.

For this reason the present invention uses the two potassium salts - the dichromate and the permanganate, which react with sulphuric acid. The acid is neutralized and free oxygen ions are released. So, for a short time, this supposed  $\text{H}_2\text{SO}_5$  with affinity only for the unburned substances and not for metal (iron) is present, the sulphuric acid has an affinity of 100% for the two salts and not for the metal.

The analysis made during the experiments have shown that, after more than 4000 hours of firing installation functioning with combustible so additivated the metallic heat exchange surfaces are covered with a protective layer, e.g. made of chromium or manganese. Chromium and manganese are to be found, together with nickel and zinc, in different concentrations, in some of the used combustibles and these ones will be kept on the metallic heat exchange surfaces. The protector layer so formed on the heat exchange surfaces won't influence at all the thermal transfer output, its width having molecular dimensions. In fact, a protective metal coating of the metallic surfaces takes place.

In order to achieve the above mentioned effects, the process according to the present invention consists in that a controlled quantity of one of the two compositions shall be introduced in the combustion air or in the combustible, having a special affinity for the sulphuric acid will react with this sulphuric acid permanently formed during the combustion of the sulphur-containing combustible releasing the free oxygen ions which have the capacity of breaking the stable bonds of the unburned substances. This way the formation of adherent deposit

on the thermal exchange surfaces is no longer possible.

**[0013]** The quantity of the composition to be introduced either in the combustion air or directly in the combustible is extremely small. Nevertheless, the effects and the advantages above mentioned are real. It is worth mentioning that both chemical compositions do not react unless the temperature in the focus reached minimum 750°C; also, the compositions are so made that once activated at temperatures over 750°C, they will continue their activity they leave the firing installations (through the chimney). Both compositions have the capacity of using some existing metals in the combustibles: Ni, Cr, Mn - metals whose salts are harmful in case they are released in the environment - for lying them down on the metallic heat exchange surfaces walls as protective layers, in those areas where the working temperatures are lower and the corrosion exposure is higher.

The addition compositions contain chromium. The chromium quantity contained by the composition reported to the chromium quantity contained by the combustible is extremely small, as well as compared with the rest of the metals contained by the combustible. For instance, in case of a boiler with a capacity of 120 t overheated steam /hour the maximum total quantity of necessary active substance is of 3 - 5 g/24 hours. Diverse types of addition installations may be used for addition of the combustion air. Still, we recommend using the installation according to the Romanian patent RO 113489, considering it's a simple and effective one and allows a more precise addition; the regulating loop is no longer necessary as the solution volume is proportionally varying with the variation of the thermal load, as the experiments have showed.

**[0014]** As shown in Fig. 2 representing the block diagram, a simple installation is used for adding a liquid combustible in its mass. The composition from a tank 1 is mixed in the due proportion with the combustible - fuel oil - from a tank 2 through a stirrer - batcher 3. The mixture so formed is then taken over by a pump 4 and introduced in a day-tank 5. The addition of the combustion gas is also easy to be made. The respectively block diagram is shown in Fig. 3. The aerosols generated by an aerosol generator 1' are passing through a pressure regulator 2' and then are injected in a gas line 3' and from here they enter, through the burner, into the focus.

**[0015]** The process for obtaining any of the two compositions includes the treatment of the active substance, consisting in a first variant in potassium dichromate in aqueous solution 6% and in a second variant in potassium permanganate in aqueous solution 5%, with monochromatic light with the wave length above mentioned. The active substance is flowing continuously and uniformly along a horizontal circulation trough in a thin layer of maximum 3mm and is slowly allowed to fall along the generating line of a horizontal quartz glass cylinder. Simultaneously the cylinder is rotating with a constant

number of revolutions around its own axis in the flowing sense of the liquid on the circulation trough. The monochromatic light generator continuously gives out the light along the cylinder axis during the whole liquid flowing period. The colour of the monochromatic light generator colour filter is chosen depending on the wavelength of the necessary monochromatic light for the active substance to be treated.

**[0016]** In a preferred embodiment of treating the composition active substance the monochromatic light generator used has a power of 20 w and a light density of 40 mW/cm<sup>2</sup>. The best results have been obtained when a glass cylinder of 600 mm length and 100 mm diameter rotating with a number of revolutions of 10 - 12 rot/min were used. On the circulation trough the liquid has to flow continuously with a uniform speed and a discharge of ~12l/min.

**[0017]** The device for the monochromatic light treatment, as shown in Fig. 1, consists of a circulation trough 1" placed with the tap hole above and parallel to a quartz glass cylinder 2" so the treated liquid is flowing along the glass cylinder 2" generating line. The glass cylinder has to be driven, by some known mean, in a continuous rotating movement with a constant number of revolutions, around its own axis. The rotating sense is the same with the liquid flowing sense on the circulation trough. Due to the fact the instantaneous liquid discharge flowing on the circulation trough has to be relatively constant it is advisable to assure the discharge by a dosage device. The cylinder has to be provided at the both ends with two ring-shaped limiters 3" which do not allow the spread of the liquid falling on the cylinder. A monochromatic light generator 4" is placed at one end of the cylinder in order to emit the light along cylinder rotation axis. A plane mirror 5" placed at the other end of the glass cylinder, perpendicularly on its axis, continuously reflects its light. The treated liquid flowing from the cylinder falls in a collector vessel 6". Due to the fact each of the two active substances is treated only with monochromatic light of a certain wavelength, the generator is provided with a colour filter 7" which can be replaced whenever necessary.

**[0018]** The composition and the process according to the present invention were applied in a relative high number of firing installations of different dimensions, using all types of combustibles. Some of the results for these two installations will be presented below.

1. VRANCART -ADJUD - ROMÂNIA company has launched on 12.03.1998 a new boiler made by CLEAVER BROOKS company form US, with the following parameters:

Q = 25 t steam/hour

P = 16 bar

T = 250°C

The boiler has continuously worked with fuel oil, until 12.06.1998 without being provided with any addition combustion installations. Deposits on the

boiler's walls as well as on the pipes to the chimney have been found when the boiler's functioning was interrupted. From that day the boiler has been provided with an air additivation installation according to the present invention. Subsequently it was stopped at the end of October 1999 one can find the deposit previously found on the boiler walls and pipes has disappeared. Moreover, despite the fact the boiler was new and of modern conception, a reduction of the fuel oil consumption with almost 5% has been noticed.

2. S.C. SOFERT S.A. company in Bacău has applied the composition and the process according to the present invention to a steam boiler with the following major technical data:

- nominal discharge 120 t/h
- nominal power 100 kgf/cm<sup>2</sup>
- overheated steam temperature 540 °C
- feed water temperature 215 °C
- combustible consumption:
  - fuel oil 7900 kg/h
  - natural gases 9230 Nm<sup>3</sup>/h

The boiler was turned on with fuel oil, functioned exclusively with fuel oil ~500 hours and there already were certain signs of being plugged. The boiler load was already limited and the steam parameters necessary for driving a turbine were impossible to be provided in working safety conditions.

The coupling of the additivation installation was made without stopping the boiler functioning, because of the steam supply for the consumers need. First stop took place at 29.12.1999 after a continuous work regime of ~2000 hours. A mixed commission has examined the results making video records, pictures and chemical analysis of the deposit found in the boiler. We will now present some of these results. In the focus chamber on the back screen:

- the screen pipes are partially clean; the existing deposits are few, non-adherent and friable; after their taking off, the pipes remain clean, closed to the metallic luster. When deposit is detached, on both the screen pipes and steel strips no more adherent layers are present.

The old deposit on the economizer serpentines have been totally removed. Only a white powder with a width of maximum 0,2 mm, easy to be removed, has been found on the serpentines.

The main effects ascertained were:

- an almost total removal of the deposit, including the old ones and the corrosion ones;
- the total disappearance of the sulphur salts;

- the total disappearance of the sulphuric acid and of sulphuric anhydride;
- the lack of unburned substances.

5 All the above-mentioned allegations can be asserted on the basis of the references obtained as a result of high load resistance applications, from 1 to 5 years, at diverse beneficiaries.

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### Claims

1. Composition for improving the combustible combustion, obtained on the basis of the chrome and manganese salts of an alkaline metal, potassium, **characterized in that** in a variant for firing installations using common liquid or gaseous combustibles as well as for firing installations using solid combustibles simultaneously with liquid and gaseous combustibles for enhancing the combustion, it includes ~ 20% of 6% watery solution of potassium dichromate, treated with monochromatic light with wave length  $\lambda \sim 480-490 \cdot 10^{-9}$  m; ammonia 0,02%; non-additivated mineral oil 0,2%; de-mineralized water ~80%, and in other variant for firing installations using solid combustibles e.g. coals, solid deposits, or liquid combustibles with high viscosity, higher than the fuel oil's, as bituminous shale, refinery deposit, it includes ~10% of 5% watery solution of potassium permanganate, treated with monochromatic light with wave length  $\lambda \sim 595-625 \cdot 10^{-9}$  m; 0,05% urea; non-additivated mineral oil 0,3%; de-mineralized water ~90%.
2. Process of using the compositions according to claim 1 **characterized in that** each of them is introduced either in the combustion air or, in case of liquid or gaseous combustible in their mass, in a ratio of 0,025 gr  $\pm 20\%$  for each 10<sup>9</sup> cal. produced.
3. Process for obtaining the composition claimed in claim 1 by the monochromatic light treatment of the active substance of the compositions according to claim 1 **characterized in that** the active substance flowing with a constant discharge along a collector trough (1") is allowed to freely fall along the generating line of a quartz glass cylinder (2") which is uniformly rotating with 10 - 12 rot/min, axially illuminated by a monochromatic light generator with a power of 20 w and a light density of 40 mw/cm<sup>2</sup>.
4. Process for obtaining the composition according to claim 3 **characterized in that** the quartz cylinder (2") is rotating itself around its longitudinal axis in the same sense as the liquid flowing sense on the circulation trough (1").
5. The process of claim 4, **characterized in that** it im-

plements a device for monochromatic light treatment of the active substances of the compositions claimed in claim 1, said device including a circulation trough (1") situated with the tap hole above and parallel to a quartz glass cylinder (2") so the treated liquid is flowing along its generating line, the glass cylinder being driven in a continuous rotation movement around its own axis with a constant number of revolutions; at its both ends the cylinder being provided with some ring-shaped limiters (3") which do not allow the liquid flowing on the cylinder to spread; a monochromatic light generator (4") provided with a colour filter (7") in order to emit the light along the cylinder rotation axis being placed at one end of the cylinder and a plane mirror (5") which reflects the light of the generator (4") being placed at the other end of the cylinder, perpendicular on its axis; a collector vessel (6") being placed under the glass cylinder (2") in order to collect the treated liquid flowing on the cylinder (2").

6. The process of claim 5, wherein, in the device for monochromatic light treatment a dosage device assures a constant instantaneous discharge of the liquid flowing on the circulation trough (1").

#### Patentansprüche

1. Zusammensetzung zur Verbesserung der Verbrennung von Brennstoffen, die auf der Basis von Chrom- und Mangansalzen eines Alkalimetalls, Kalium, erhalten wird, **dadurch gekennzeichnet, dass** sie in einer Variante für Feuerungsanlagen, die übliche flüssige oder gasförmige Brennstoffe verwenden, sowie für Feuerungsanlagen, die gleichzeitig mit flüssigen und gasförmigen Brennstoffen feste Brennstoffe verwenden, zur Verbesserung der Verbrennung ~20% einer 6%igen wässrigen Kaliumdichromatlösung, die mit monochromatischem Licht mit einer Wellenlänge  $\lambda \sim 480-490 \cdot 10^{-9}$  m behandelt ist; 0,02% Ammoniak; 0,2% nicht mit Additiven versehenes Mineralöl; und ~80% vollentsalztes Wasser umfasst, und sie in einer anderen Variante für Feuerungsanlagen, die feste Brennstoffe, z.B. Kohlen, feste Ablagerungen, oder flüssige Brennstoffe mit hoher Viskosität, die höher ist als die der Brennstofföle, wie Ölschiefer, Raffinerieablagerungen, verwenden, ~10% einer 5%igen wässrigen Kaliumpermanganatlösung, die mit monochromatischem Licht mit einer Wellenlänge  $\lambda \sim 595-625 \cdot 10^{-9}$  m behandelt ist; 0,05% Harnstoff; 0,3% nicht mit Additiven versehenes Mineralöl; und ~90% voll entsalztes Wasser umfasst.
2. Verfahren zur Verwendung der Zusammensetzungen nach Anspruch 1, **dadurch gekennzeichnet, dass** jede von diesen entweder in die Verbren-

nungsluft oder, im Fall von flüssigern oder gasförmigern Brennstoff, in deren Masse in einem Verhältnis von 0,025 gr  $\pm 20\%$  für jede produzierte  $10^9$  cal. eingeleitet wird.

3. Verfahren zum Erhalten der Zusammensetzung nach Anspruch 1 durch die Behandlung der aktiven Substanz mit den Zusammensetzungen nach Anspruch 1 mit monochromatischem Licht, **dadurch gekennzeichnet, dass** zugelassen wird, dass die aktive Substanz, die mit einem konstanten Austrag längs einer Sammlerwanne (1") strömt, frei entlang der Erzeugenden eines Quarzglaszylinders (2") fallen kann, der gleichmäßig mit 10-12 U/min rotiert, wobei dieser durch einen Generator für monochromatisches Licht mit einer Leistung von 20 W und einer Lichtdichte von 40 mW/cm<sup>2</sup> axial beleuchtet wird.
4. Verfahren zum Erhalten der Zusammensetzung nach Anspruch 3, **dadurch gekennzeichnet, dass** der Quarzzyylinder (2") selbst um seine Längsachse in der gleichen Drehrichtung wie die Flüssigkeitsströmungsrichtung an der Zirkulationswanne (1") rotiert.
5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** es eine Vorrichtung zur Behandlung der aktiven Substanzen der in Anspruch 1 beanspruchten Zusammensetzungen mit monochromatischem Licht einsetzt, wobei die Vorrichtung umfasst: eine Zirkulationswanne (1"), die mit dem Zapfloch oben und parallel zu einem Quarzglaszylinder (2") gelegen ist, so dass die behandelte Flüssigkeit entlang seiner Erzeugenden strömt, wobei der Glaszylinder in einer kontinuierlichen Drehbewegung um seine eigene Achse mit einer konstanten Anzahl von Umdrehungen angetrieben wird; wobei der Zylinder an seinen beiden Enden mit einigen ringförmigen Begrenzungseinrichtungen (3") versehen ist, die es nicht zulassen, dass die auf den Zylinder strömende Flüssigkeit sich ausbreitet; einen Generator für monochromatisches Licht (4"), der mit einem Farbfilter (7") versehen ist, um das Licht entlang der Drehachse des Zylinders auszustrahlen, und an einem Ende des Zylinders angeordnet ist, und einem ebenen Spiegel (5"), der das Licht des Generators (4") reflektiert und an dem anderen Ende des Zylinders senkrecht auf seiner Achse angeordnet ist; ein Sammelgefäß (6"), das unter dem Glaszylinder (2") angeordnet ist, um die auf dem Zylinder (2") strömende behandelte Flüssigkeit zu sammeln.
6. Verfahren nach Anspruch 5, wobei in der Vorrichtung zur Behandlung mit monochromatischem Licht eine Dosiereinrichtung einen konstanten momentanen Austrag der auf der Zirkulationswanne (1") strö-

menden Flüssigkeit sicherstellt.

## Revendications

1. Composition pour améliorer la combustion d'un combustible, obtenue à partir de sels de chrome et de manganèse d'un métal alcalin, le potassium, **caractérisée en ce que**, selon une variante pour des installations de cuisson utilisant des combustibles usuels liquides ou gazeux ainsi que pour des installations de cuisson utilisant les combustibles solides simultanément aux combustibles liquides et gazeux, pour améliorer la combustion, elle comprend environ 20 % de solution aqueuse de dichromate de potassium à 6 %, traitée avec de la lumière monochromatique ayant une longueur d'ondes  $\lambda$  d'environ  $480 \text{ à } 490 \cdot 10^{-9} \text{ m}$  ; 0,02 % d'ammoniac ; 0,2 % d'une huile minérale sans additif ; et environ 80 % d'eau déminéralisée, et **en ce que**, selon une autre variante pour des installations de cuisson utilisant des combustibles solides, par exemple des charbons, des dépôts solides ou des combustibles liquides ayant une viscosité élevée, supérieure à celle des huiles lourdes, comme les schistes bitumineux, les dépôts de raffinerie, elle comprend environ 10 % de solution de permanganate de potassium à 5 %, traitée avec de la lumière monochromatique ayant une longueur d'onde  $\lambda$  d'environ  $595 \text{ à } 625 \cdot 10^{-9} \text{ m}$  ; 0,05 % d'urée ; 0,3 % d'une huile minérale sans additif ; et 90 % d'eau déminéralisée.
 

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2. Procédé d'utilisation des compositions selon la revendication 1, **caractérisé en ce que** chacune d'elles est introduite soit dans l'air de combustion soit, dans le cas de combustible liquide ou gazeux, dans leur masse, avec un rapport de  $0,025 \text{ gr} \pm 20 \%$  pour chaque  $10^9 \text{ cal. produit}$ .
 

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3. Procédé de préparation de la composition de la revendication 1 par le traitement à la lumière monochromatique de la substance active des compositions selon la revendication 1, **caractérisé en ce que** on laisse la substance active s'écoulant en un déchargement constant le long d'un canal de collecte (1") tomber librement le long de la ligne de génération d'un cylindre de verre en quartz (2") qui tourne uniformément à 10 - 12 tours/min., et qui est illuminé axialement par un générateur de lumière monochromatique avec une puissance de 20 W et une densité de lumière de  $40 \text{ mW/cm}^2$ .
 

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4. Procédé d'obtention de la composition selon la revendication 3, **caractérisé en ce que** le cylindre en quartz (2") tourne lui-même autour de son axe longitudinal dans le même sens que le sens d'écoulement du liquide sur le canal de circulation (1").
 

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5. Procédé selon la revendication 4, **caractérisé en ce que** il met en oeuvre un dispositif pour le traitement à la lumière monochromatique des substances actives des compositions revendiquées dans la revendication 1, ledit dispositif comprenant un canal de circulation (1") situé avec l'orifice de coulée sur le dessus et parallèle à un cylindre en verre de quartz (2") de manière à ce que le liquide traité s'écoule le long de sa ligne de génération, le cylindre en verre étant entraîné en un mouvement de rotation continu autour de son axe avec un nombre constant de tours ; au niveau de ses deux extrémités, le cylindre étant muni de limiteurs en forme d'anneaux (3") qui ne permettent pas au liquide de s'écouler sur le cylindre pour se répandre ; un générateur de lumière monochromatique (4") muni d'un filtre coloré (7") afin d'émettre de la lumière le long de l'axe de rotation du cylindre étant placé à une extrémité du cylindre et un miroir plan (5") reflétant la lumière du générateur (4") étant placé à l'autre extrémité du cylindre, de manière perpendiculaire à son axe ; un récipient de collecte (6") étant placé en dessous du cylindre de verre (2") afin de collecter le liquide traité s'écoulant sur le cylindre (2").
 

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6. Procédé de la revendication 5, dans lequel, dans le dispositif de traitement à la lumière monochromatique, un dispositif de dosage assure un déchargement instantané constant du liquide s'écoulant sur le canal de circulation (1").
 

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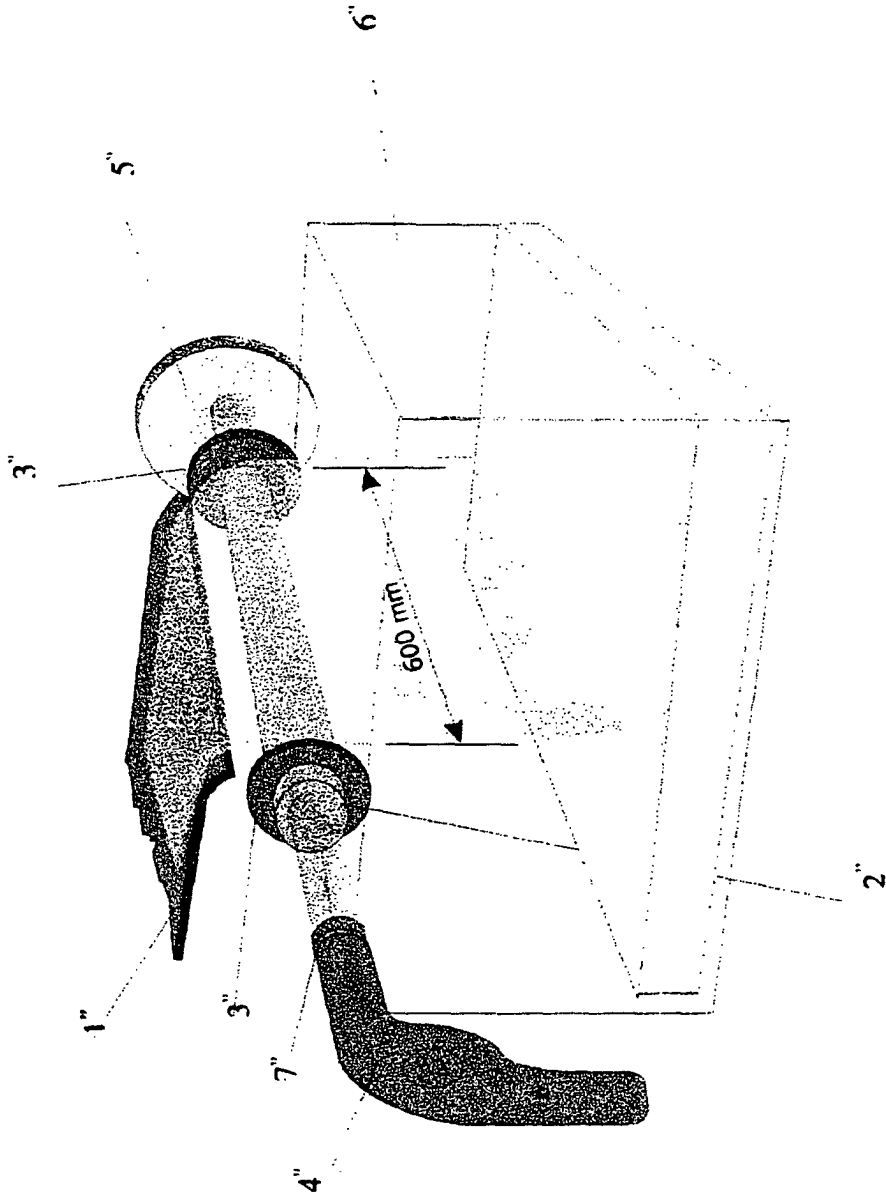
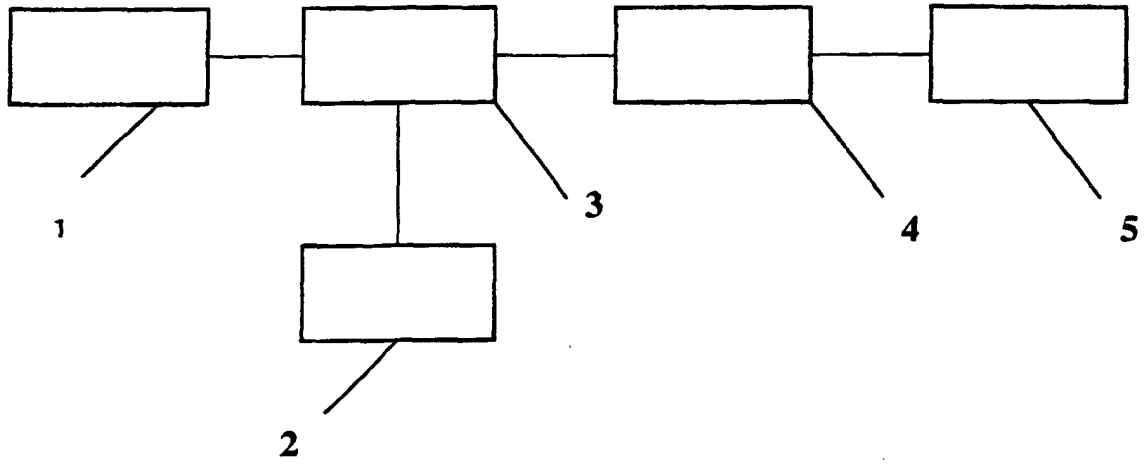


Fig. 1

**Fig. 2**



**Fig. 3**

